IPEA
EPO
D-80298 Munich
Germany

10th February 2005

Dear Sirs

PCT/GB03/02784

Our ref: Architect Gen (PCT)

Thank you for your Written Opinion dated 10th December 2004. The Opinion is an auto-generated Opinion which states in essence that the invention as claimed lacks novelty and/or inventive step in light of the art cited in the Search Report.

The Search Report cites 2 category Y documents against the independent claims:

D1	US 6408428 (HP)
D2	Athanas et al

In light of the citations, the applicant files replacement pages 3 and 30 to replace page 3 and 30 as originally filed

Triplicate copies will follow by post, together with one set marked to show all changes.

US 6408428 B1 (SNIDER GREG ET AL)

This citation provides a very detailed description of a VLIW architecture based on the PICO technology developed by Hewlett-Packard. This contains some of the same elements and themes as the CriticalBlue disclosure, including the adaptation of the instruction set to the requirements of a particular application program. The architecture is more traditional VLIW in nature with clusters of functional units connected to a

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number of register files. Analysis is done to determine a good combination of functional units to allocate to each slot.

The major difference between this citation and the CriticalBlue approach is related to the nature of the connectivity between the functional units. In the citation communication between the functional units is via one of a number of register files. Analysis is performed to determine how to allocate ports between the register file and the functional units, but there is *no direct connectivity between functional units.* The CriticalBlue approach allows connectivity directly between the functional units, thus allowing the dataflows in the original software application to be directly reflected in the architecture. The advantage of the CriticalBlue approach is that it allows much greater customisation of connectivity.

PROCESSOR RECONFIGURATION (ATHANS P M ET AL)

This is a somewhat outdated article which describes the state of the art in automatic custom instruction extraction. It discusses the benefit of being able to extract specialized instructions automatically from high level software languages. Certain operations can be performed much more quickly in custom hardware, allowing much higher levels of performance to be achieved. The experimental framework (PRISM-1) uses a standard microprocessor connected to an external FPGA into which the customized hardware can be configured.

This citation takes a very different approach to that of CriticalBlue. Rather than generate a processor that is optimised for an application the approach in the citation is to retain a fixed processor and then generate custom hardware blocks for certain parts of the software. These hardware blocks are generated using a behavioral synthesis approach, whereby the custom hardware block is, in itself, not programmable in any way and represents a facsimile of the dataflow of the original software. There is no discussion of any means to reuse operational units within the hardware and to optimise the number of them, and the connectivity between them, in order to balance area and performance. These are key aspects to the CriticalBlue application.